Introduction to Acquisition Logistics

A defense contractor once told me that his company would have an easier time developing new Army equipment if they didn't have to worry about logistics planning!

Traditionally, logistics planning has taken a backseat to weapon system design. Maximum range, speed, payload, rate of fire, and stealth are examples of more glamorous system attributes that capture the warfighters' attention. Somebody may state, "I want my helicopter to be able to fly between 200 - 250 miles per hour, carry 15 to 20 fully-equipped combat soldiers, and have an unrefueled range between 500 - 700 miles!" A logistician, after hearing these requirements may ask, "What is the operational readiness requirement for this helicopter? How much maintenance will be required after each mission? What levels of maintenance will be required? Who will perform the maintenance?"

Logistics is, "the science of planning and carrying out the movement and maintenance of forces. In its most comprehensive sense, those aspects of military operations which deal with: (1) design and development, acquisition, storage, movement, distribution, maintenance, evacuation, and disposition of materiel; (2) movement, evacuation, and hospitalization of personnel; (3) acquisition or construction, maintenance, operation, and disposition of facilities; and (4) acquisition or furnishing of services."[1]

Estimated Life Cycle Costs

Major category	**Percentage**
Research and development	15
Procurement	20
Operating and Support	65
Total	100

The majority of a system's life-cycle costs can be directly attributed to operation and support costs that accrue after the system is fielded. Because these costs are largely determined early in system development, it is vitally important that system developers evaluate the potential operation and support costs of alternate designs and factor these into early design decisions.[2] The Army's acquisition logisticians have this responsibility.

Department of Defense and Army policies regarding acquisition logistics are clear:

> "Logistics transformation is fundamental to acquisition reform. Decision-makers shall take all appropriate enabling actions to integrate acquisition and logistics to ensure a superior product support process. The Department (DoD) shall strive for an integrated acquisition and logistics process characterized by constant focus on total cost of ownership; supportability as a key design and performance factor; logistics emphasis in the systems engineering process; and that meets the challenges of rapidly evolving logistics systems supporting joint operational forces."[3]

[1] DoD Dictionary
[2] MIL-HDBK-502, *Acquisition Logistics*.
[3] DoD 5000.1, The Defense Acquisition System

"The Department of the Army holds supportability to be co-equal in importance with the materiel development considerations of cost, schedule, and performance. Accordingly, it is incumbent upon everyone involved in the acquisition and logistics processes to ensure that system supportability is fully addressed throughout the development, acquisition, fielding, and utilization of the system. AR 700-127, Integrated Logistic Support, provides Army policy on supportability planning and execution."[4]

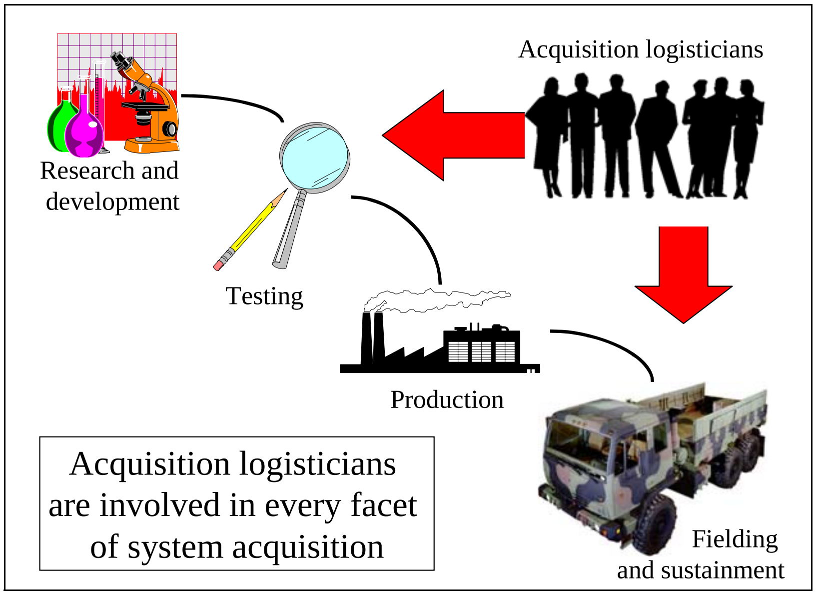
Objectives

1. Define acquisition logistics and describe the objectives of the integrated logistics support program.
2. Recognize the current shift in philosophy from organic to contractor support.
3. Describe the ten ILS elements.
4. Describe the Army maintenance levels.
5. Define supportability
6. Define:
    a. System readiness objectives (SRO).
    b. Maintenance concept.
    c. Level of repair analysis (LORA).
    d. Battlefield damage assessment and repair (BDAR).
    e. Interservice maintenance.
    f. Materiel fielding.
    g. Manpower and Personnel Integration (MANPRINT).
    h. Provisioning.
    i. Human factors engineering (HFE).
    j. Logistics Management Information (LMI).
    k. Qualitative and Quantitative Personnel Requirements Information (QQPRI).

[4] Army Policy – Supportability Co-Equal with Cost, Schedule and Performance, 27 Feb 2000.

What is acquisition logistics?

Acquisition logistics is a multi-functional, technical management discipline associated with the design, development, test, production, fielding, sustainment, and improvement or modification of cost-effective systems that achieve the user's peacetime and wartime readiness requirements.[5]



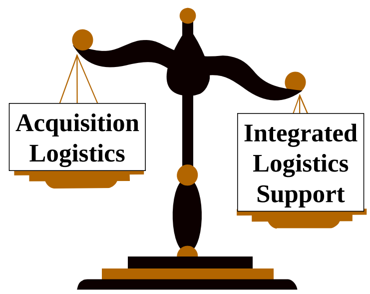
The principal **objectives of acquisition logistics** are to (1) ensure that support considerations are an integral part of the system's design requirements, (2) that the system can be cost effectively supported through its life-cycle, and (3) that the infrastructure elements necessary to the initial fielding and operational support of the system are identified and developed and acquired.

Alternatively, the Army often uses the term, **integrated logistics support (ILS)**, defined as a unified and iterative approach to the management and technical activities needed to:

1. Influence operational and materiel requirements and design specifications.
2. Define the support requirements best related to system design and to each other.
3. Develop and acquire the required support.
4. Provide required operational phase support at lowest cost.
5. Seek readiness and LCC improvements in the materiel system and support systems during the operational life cycle.
6. Repeatedly examine support requirements throughout the service life of the system.

[5] MIL-HDBK 502, Acquisition Logistics

Both terms mean the same thing!



As you will note, acquisition logistics and integrated logistics support mean the same thing. As a matter of history, DoD originally used the term, integrated logistics support, but changed it to acquisition logistics several years ago. These terms are used interchangeability throughout this course and in the field.

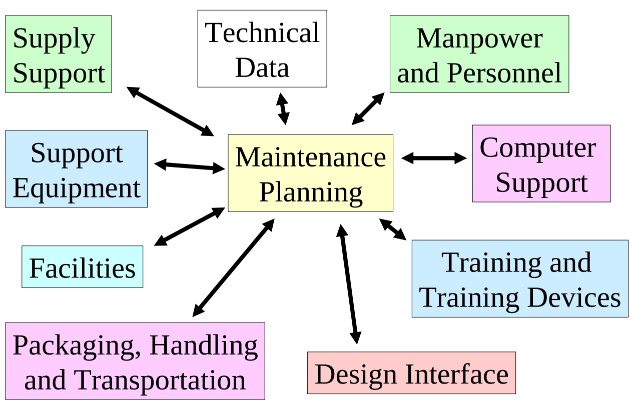
While the definitions and objectives of acquisition logistics and integrated logistics support may sound a little complicated, let's compare them to a hypothetical situation within the automobile industry.

An automobile manufacturer spends several years developing and testing a new model car. The car is then manufactured and transported to automobile dealers. During the development phase, designers create a new body style, interior, and incorporate other features such as safety, which will attract customers. The automobile manufacturer must also create service manuals, test equipment, special tools, and maintenance courses for the service employees of automobile dealerships. The automobile dealerships and manufacturer must also stock parts. What would happen if an automobile dealer sold you a car without any provision for its service? I can imagine your conversation with that automobile dealer when your car needed maintenance!

Acquisition logistics elements

The Army has identified ten separate elements of acquisition logistics. It is important to note that while these are separate elements, each element of logistics support is directly related to one another and cannot stand alone. The elements are:

Relationship of Logistics Elements



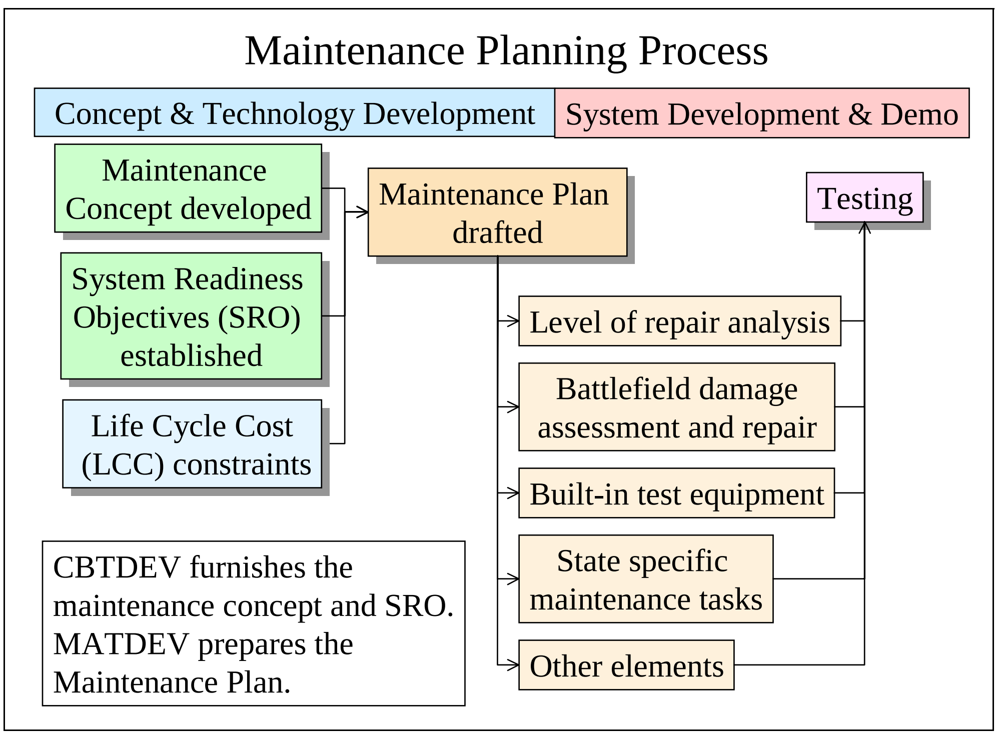
ILS Elements

1. Maintenance planning.
2. Manpower and personnel.
3. Supply support.
4. Equipment support.
5. Technical data.
6. Training and training support.
7. Computer resources support.
8. Facilities.
9. Packaging, handling, storage, and transportation.
10. Design interface.

A detailed explanation of each element follows.

Maintenance Planning is the process conducted to evolve and establish maintenance concepts and requirements for the lifetime of the system. Because of the impact on systems design and the long term operations and support cost implications, a cost-effective support concept is established early in the program during the early part of the Concept and Technology Development Phase (Concept Exploration). The support concept considers all viable alternatives and is refined concurrently with the design effort into detailed maintenance plans.

Maintenance planning begins with developing the maintenance concept. A **maintenance concept** is a general description of the maintenance tasks required to support the equipment and designating the maintenance level to perform each task. (e.g., full organic, interim contractor support, lifetime contractor support). The maintenance concept is usually incorporated into the more specific maintenance plan. Maintenance planning is conducted to evolve and establish requirements and tasks to be accomplished for achieving, restoring, and maintaining the operational capability for the life of the materiel system. Maintenance planning relies on **level of repair analysis** (LORA) as a function of the systems analysis process.



Maintenance planning will:

1. Define the actions and support needed to ensure that the system attains its **system readiness objectives** (SRO) within minimum life cycle costs (LCC).
2. Set up specific criteria for equipment repair (in terms of time and accuracy, and repair levels; **Battlefield Damage Assessment and Repair** (BDAR); Built-in

Test Equipment (BITE); testability, reliability, and maintainability; nuclear hardening; support equipment requirements (including automatic test equipment); and manpower skills and facility requirements for peacetime and wartime environments.

3. State specific maintenance tasks (including Battlefield Damage Assessment and Repair procedures) to be performed on the materiel system.
4. State any Interservice maintenance requirements, proposed organic and contractor mix, projected workloads, and time phasing for accomplishing depot maintenance requirements.
5. State the extent, duration, and use of interim contractor support (when applicable) and plans for transition to organic support.
6. Define actions and support required for **materiel fielding** (MF).
7. Address warranty considerations. AR 700-139
8. Define host nation support (HNS) requirements. (Also, see cooperative logistics.)
9. Ensure that **manpower and personnel integration** MANPRINT considerations are included in the maintenance concept. The maintenance concept must prudently use manpower and other resources. Performing maintenance tasks must not exceed available or achievable soldier capabilities. Skill-level relationships must be optimized. When formulating the maintenance concept, you should analyze the proposed work environment on the health and safety of maintenance personnel. Also, see QQPRI and BOIP.
10. Identify **nuclear hardness** (NH) surveillance procedures to monitor and preserve the nuclear hardness of the materiel system.
11. Establish precautions to identify nuclear hardness features during maintenance operations on the equipment or to restore the nuclear hardness features of the equipment when they are disturbed as a result of maintenance actions.
12. Ensure that maintenance planning incorporates criteria of Army maintenance policies and that using maintenance float (operational readiness float (ORF) and repair cycle float (RCF)) is approved by HQDA (Deputy Chief of Staff for Logistics). (AR 40-61, AR 750-1, and AR 750-2)
13. Conduct a level of repair analysis (LORA) to optimize the support system in terms of: life cycle costs (LCC), system readiness objectives (SRO), design for discard, maintenance task distribution, support equipment and automatic test equipment (ATE), workload distribution, and manpower and personnel requirements.
14. Minimize the use of hazardous materials and the generation of waste.

Army Maintenance Levels[6]

<table>
<tr><th colspan="3">Organic maintenance</th><th>Contract maintenance</th></tr>
<tr><td>4-level (standard)</td><td>3-level (aviation)</td><td>2-level</td><td>(Contractor Logistics Support)</td></tr>
<tr><td>Depot</td><td>Depot</td><td rowspan="3">Depot</td><td rowspan="5">Contractors can perform any level of maintenance (organization – depot). The maintenance contract duration can range from an interim period of time (months) through the entire life of the system being supported.
Host nation support is considered contract maintenance.</td></tr>
<tr><td>General support</td><td rowspan="2">Intermediate (AVIM)</td></tr>
<tr><td>Direct support</td></tr>
<tr><td>Organization</td><td>Unit (AVUM)</td><td>Unit</td></tr>
<tr><td colspan="3">Organic maintenance - Maintenance performed by a military Service under military control using Government-owned and Government-operated facilities, tools, test equipment, spares, repair parts, and military or Government civilian personnel.</td></tr>
</table>

The Army has begun outsourcing more of its logistics support as a result of Congressional pressure, changing Government philosophy and military end-strength reductions. There is a continuing debate over core versus non-core Government functions. Contractors want more Government functions to be outsourced while many Army civilians and military want to retain in-house logistics capabilities. Some Government employees are willing to compete with contractors within this arena. Although this issue is not fully resolved, high-level outsourcing decisions are being made which will shape the future Army structure.

Manpower and Personnel. Identifying and acquiring military and civilian personnel with the skills and grades required to operate and support the system over its lifetime at peacetime and wartime rates. Program managers minimize the quantity of personnel and exotic skill levels required to operate and maintain systems because personnel affordability is a prime consideration in system acquisition. These considerations are sometimes referred to as the **Qualitative and Quantitative Personnel Requirements Information** (QQPRI).[7] The materiel developer prepares the QQPRI and sends the document to the combat developer who then prepares a Basis of Issue Plan (BOIP). The BOIP is the foundation of the Table of Organization and Equipment (TOE).

Supply Support. All management actions, procedures, and techniques used to determine requirements to acquire, catalog, receive, store, transfer, issue, and dispose of secondary items. This includes provisioning for both initial support and replenishment supply support, and acquiring logistics support for support and test equipment. **Provisioning** is, 'a management process for determining and acquiring the range and quantity of support items necessary to operate and maintain an end item of materiel for an initial period of service.'[8]

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[6] AR 750-1, Army Materiel Maintenance Policy and Retail Maintenance Operations

[7] *AR 71-2, Basis of Issue Plans (BOIP) and Qualitative and Quantitative Personnel Requirements Information (QQPRI).*

[8] *AR 700-18, Provisioning of US Army Equipment.*

Support Equipment. All equipment (mobile or fixed) required to support the operation and maintenance of the system. This includes associated multi-use end items, ground handling and maintenance equipment, tools, metrology and calibration equipment, test equipment, and automatic test equipment.

Technical Manuals and Technical Data. Scientific or technical information recorded in any form or medium (such as manuals and drawings). Computer programs and related software are not technical data whereas the documentation of computer programs and related software are technical data. Also excluded are financial data or other information related to contract administration. Technical data includes:

- Technical manuals (TM).
- Technical and supply bulletins (TB & SB).
- Transportability guidance technical manuals.
- **Maintenance expenditure limits** (MEL) and calibration procedures.
- Repair parts and special tools list (RPSTL).
- Maintenance allocation charts (MAC).
- Lubrication orders (LO).
- Drawings, specifications -the technical data package (TDP).
- Software documentation.
- Provisioning documentation.
- **Depot Maintenance Support Plan** (DMSP)
- Identification lists.
- Component lists.
- Product support data.
- Flight safety critical parts list.
- Explosive ordinance disposal (EOD) render safe procedure information for explosives.
- Military Traffic Management Command – Transportation Engineering Agency (MTMCTEA) lifting and tie down pamphlet and references.
- Hazardous material documentation
- It includes data derived from basic and applied research in MANPRINT-related areas such as **human factors engineering** (HFE), soldier-machine interface, and psychophysiology. MANPRINT data must be considered in establishing ILS-related design requirements and identifying ILS resource requirements. It is also applied in developing technical manuals and other publications to ensure they conform to established user capabilities.

Source: http://www.logsa.army.mil/alc/127/bm1_6

Training and Training Support. Training and training support encompasses the processes, procedures, techniques, training devices, and equipment used to train civilian and military personnel to operate and support a materiel system. This element defines qualitative and quantitative requirements for training of operating and support personnel, throughout the life cycle of the system. It includes requirements for:

- Factory training.

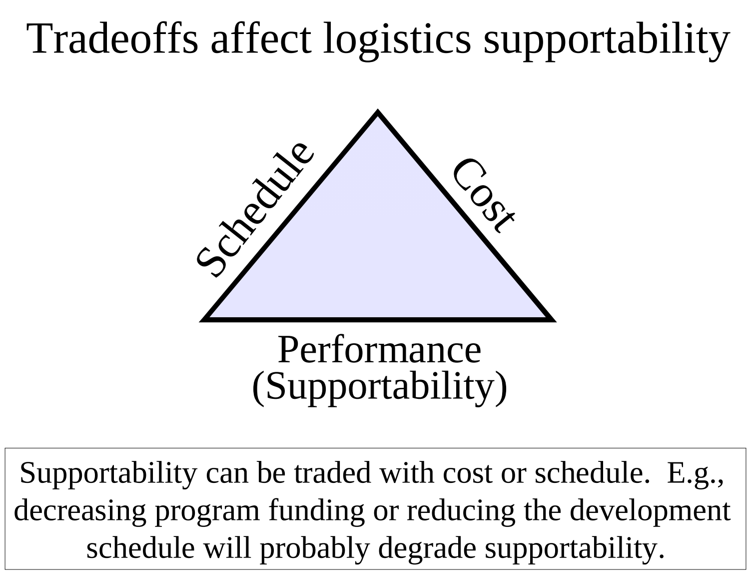
- Instructor and key personnel training.
- New equipment training team.
- Resident training.
- Sustainment training at gaining installations.
- Joint Service training requirements.
- EOD/Render Safe Procedures training.
- Embedded training devices, features, and components are designed and built into a specific end item or system to provide training in the use of the item or system. The design, development, delivery, installation, and logistic support of required embedded training features, mockups, simulators, and training aids are also included.

Computer Resources Support. Computer resources support includes the facilities, hardware, software, documentation, manpower, and personnel needed to operate and support computer systems. Computer resources include both stand-alone and embedded systems. This element is usually planned, developed, implemented, and monitored by a computer resources working group that documents the approach and tracks progress via a computer resources management plan (CRMP). Combat and materiel developers will ensure that planning actions and strategies contained in the ILSP and CRMP are complementary and that computer resources support (materiel system operational software, ATE operational software, and post deployment software support (PDSS) are available where and when needed.

Facilities. The facilities element is composed of a variety of planning activities all of which are directed toward ensuring that all required permanent or semipermanent operating and support facilities (for instance, training, field and depot maintenance, storage, operational, and testing) are available concurrently with system fielding. Planning must be comprehensive and include the need for new construction as well as construction modifications to existing facilities. Typically, facility construction takes from 5 to 7 years from concept formulation to user occupancy. It also includes studies to define and establish impacts on LCC, Military Construction Appropriations (MCA) funding requirements, facility locations and improvements, space requirements, environmental impacts, duration or frequency of use, safety and health standards requirements, and security restrictions. Also included are any utility requirements, for both fixed and mobile facilities, with emphasis on limiting requirements of scarce or unique utilities.

Packaging, Handling, Storage and Transportation. This logistics element includes resources and procedures to ensure that all system equipment and support items are preserved, packaged, packed, marked, handled, transported and stored properly for short and long-term requirements. It includes materiel handling equipment and packaging, handling and storage requirements of pre-positioning of materiel configured to unit sets (POMCUS) stocks. It also includes preservation and packaging level requirements and storage requirements (for example classified, sensitive, and controlled). This element includes planning and programming the details associated with movement of the system in its shipping configuration to the ultimate destination via transportation modes and networks available and authorized for use. It further encompasses establishment of critical engineering design parameters and constraints (width, length, height, component and system rating, and weight) that must be considered during system development. Customs requirements, airdrop requirements, container considerations, special movement precautions, units mobility (to include prescribed load list and authorized stockage list PLL/ASL), and theater transportation asset impact must be carefully assessed. (See AR 700-47).

Design Interface. Design interface is the relationship of logistics-related design parameters of the system to its projected or actual readiness support resource requirements. These design parameters are expressed in operational terms rather than as inherent values and specifically relate to system readiness objectives and support costs of the system. Programs such as Design for Testability and Design for Discard must be considered during system design. "The single most important aspect of ILS is design influence, which is accomplished within the system engineering process. Influencing design up front has a significant impact on future operations and support (O&S) costs, considering that O&S costs comprise 60%-70% of a weapon systems life cycle cost (LCC). When evaluating performance, System Managers, Life Cycle Software Engineer Centers (LCSECs), and integrated logistics support managers take into account supportability and its everlasting effect on the life cycle cost of a weapon system."[9]



Reducing supportability below a threshold may prevent the system from meeting its requirements (system readiness objectives).

RAM are key design parameters that influence both the performance (mission effectiveness and system availability) and economics (support requirements and life cycle costs (LCC)) of the materiel system. RAM are true engineering design parameters and are usually managed as engineering disciplines. However, the performance aspects of RAM must be balanced with the economic aspects of the element. Quantitative limitations must be included when determining maintainability constraints.

Military services and civilian industries all have horror stories citing examples of where the individual logistic elements were not properly integrated with one another and with the system. The inevitable results were inadequate logistics support, delays in field-

[9] DA PAM 70-3, Research, Development and Acquisition – Acquisition Procedures.

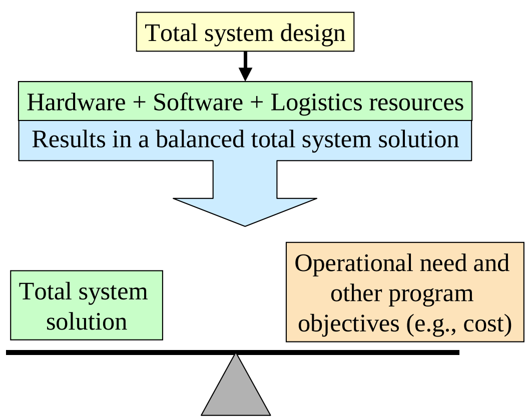
ing a materiel system, program cost overruns, or all of the above. Logistics may well have been the topic when the following quotation was expressed, "We never have time to do it right, but we always have time to do it over!"

Acquisition logistics' relationship to systems engineering

Acquisition logistics activities are most effective when they are integral to both the contractor's and Government's systems engineering technical and management processes. When this is the case, system designers, acquisition logisticians, and program managers are best able to identify, consider, and tradeoff support considerations with other system cost, schedule, and performance parameters to arrive at an optimum balance of system requirements that meet the user's operational and readiness requirements.

"Systems engineering is an interdisciplinary approach to evolve and verify an integrated and life-cycle balanced set of product and processes solutions that satisfy stated customer needs.

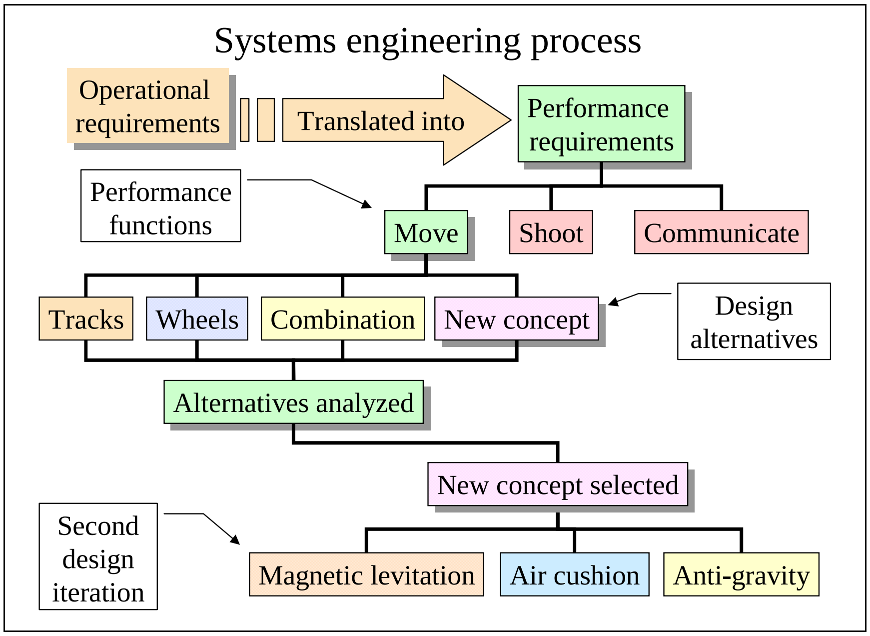
Systems engineering and logistics



A total system design would include product hardware, software, and planned logistics resources. This structured, or process, approach integrates the essential elements and design decisions of three interrelated design efforts. The result is a balanced, total system solution to the operational need and other program objectives.

The systems engineering process is used to translate operational users' needs into requirements and requirements into designs which meet program performance, cost, and schedule requirements.

The systems engineering process follows a logical top-down progression of design refinement. It uses an iterative process in which operational requirements are translated into performance requirements for the functional elements of a system. Design alternatives for each of the system's functional elements are identified and analyzed. The results are used to select the best combination of element designs to achieve the system objective. Performance requirements are refined based upon the selected alternatives, and the updated requirements are further decomposed to the next level of performance function. Once again alternatives are identified and analyzed, and the process is repeated.



The functional decomposition of requirements continues to the lowest logical breakdown of a performance function. At this point the top-down design becomes a bottom-up build. Synthesis of the physical design begins when hardware items are selected to provide identified functions and are arranged in a physical relationship with one another. During this stage of the design's development, analysis is used to verify adherence to each successively higher level of requirement. Estimates and projections are refined and verified through demonstrations and tests.

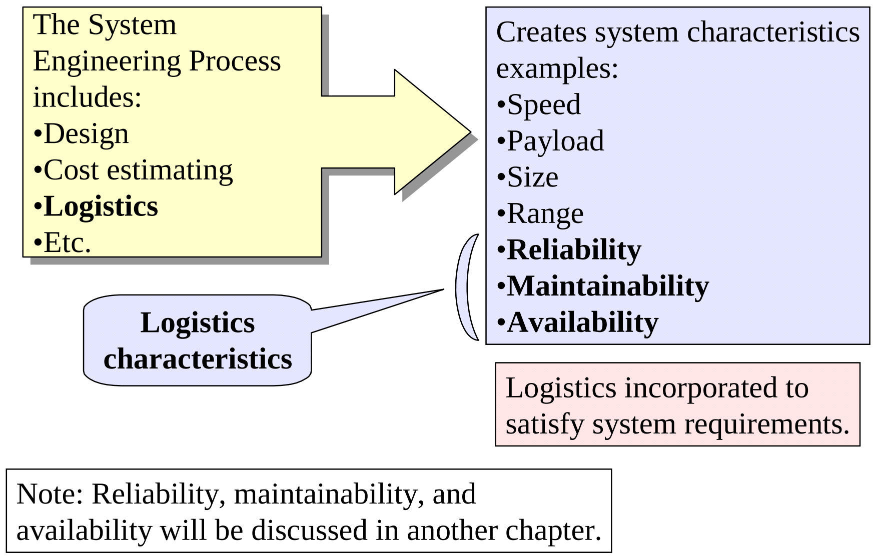
System analysis and control activities in a program serve as a basis for evaluating alternatives, selecting the best solution, measuring progress, and documenting design decisions. These activities include:

- Trade-off studies among requirements, design alternatives, and other cost, schedule and performance-related issues.
- Risk management that, throughout the design process, identifies and evaluates potential sources of technical risks based on the technology being used, the design, manufacturing, test and support processes being used, and risk mitigation efforts.
- Configuration management to control the system products, processes and related documentation. The configuration management effort includes identifying, documenting, and verifying the functional and physical characteristics of an item; recording the configuration of an item; and controlling changes to an item and its documentation. It provides a complete audit trail of decisions and design modifications.
- Data management to capture and control the technical baseline (configuration documentation, technical data, and technical manuals), provide data correlation and traceability, and serve as a ready reference for the systems engineering effort.
- Establishing performance metrics to provide measures of how well the technical development and design are evolving relative to what was planned and relative to meeting system requirements in terms of performance, risk mitigation, producibility, cost, and schedule.
- Establishing interface controls to ensure all internal and external interface requirement changes are properly recorded and communicated to all affected configuration items.
- Structuring program review to demonstrate and confirm completion of required ac-

complishments and their exit criteria as defined in program planning.

Determining the best set of planned logistic resources for a system is the function of the acquisition logistics discipline within the system engineering process. Each system concept has design characteristics. Some of these design characteristics are related to supportability.

Logistics influencing system design



Reducing supportability risks

The following are areas of supportability risks and acceptable means of reducing these risks.

1. **Logistics Management Information** (LMI) is used throughout the acquisition process to evaluate design approaches and alternative support concepts to achieve system readiness and support objectives, and to develop detailed design of the support system and requirements. Weapon system programs that have either delayed the application of LMI or have not integrated it effectively into the design analysis process are headed for trouble. The result is supportability deficiencies that increase costs and require additional engineering changes to correct these deficiencies late in the development and production process.

Outline for reducing risk

- Design objectives and developing design options to achieve readiness and supportability objectives are required by the engineering statement of work (SOW).
- LMI is integrated into the design process to determine design impact on support.

- The LMI process identifies high leverage subsystem and component reliability and maintainability efforts needed to achieve readiness and deployment objectives.
- Quantitative logistics and supportability requirements are given explicit weight in source selection.
- LMI data is derived from the same source data used by design and test engineering.
- The engineering disciplines have an "agreed to" methodology for quantifying readiness and supportability design impacts.
- Disposition of LMI-identified cost and performance drivers are coordinated with the users to permit meaningful tradeoffs.
- Adequate funding and technical manpower are programmed to perform LMI analyses required during the Concept and Technology Development Phase and follow-up.

Supportability analyses must be started early in the development process to explicitly address supportability and support requirements throughout the design, development, and production process.

2. Weapon systems and support systems must be designed with as complete an understanding as possible of user manpower and personnel skill profiles. A mismatch yields reduced field reliability, increased equipment training, technical manual costs, and redesign as problems in these areas are discovered during demonstration tests and early fielding. Discovery of increased skill and training requirements late in the acquisition process creates a difficult catch-up problem and often leads to poor system performance.

Outline for Reducing Risk

- Manpower and skill requirements are based on formally analyzing previous experience on comparable systems and maintenance concepts. This is done under contract during the research and development phases.
- RFPs reflect a priority for reducing manpower quantities or skill requirements. l% is backed up by detailed descriptions of current and projected manpower skill resources and shortfalls. This data includes specific information on current maintenance and operator performance and realistic manpower costs on similar fielded systems.
- Arrangements are made for the contractor to observe maintenance performed in the field in order to gain appreciation for capabilities and constraints.
- Manpower cost factors used in design and support tradeoff analyses take into account costs to train or replace experienced personnel, as well as billet and true overhead costs.

Manpower and skill requirements are established early in the Concept and Technology Development Phase and are considered as prime design considerations during development. They are addressed specifically during supportability analyses. Tradeoffs in design are made to minimize their requirements.

3. Weapon system supportability is dependent on reliable and maintainable support and test equipment that can be deployed with the prime system. However, developing, producing, and fielding this equipment have been a common source of risks in terms of in-

creased costs, schedule delays, and poor performance and readiness for fielded systems. The more significant causes of this risk are: (1) delayed identification of support equipment requirements; (2) design and development of software intensive support equipment before design stability of the system it supports; (3) underestimation of software requirements and development costs; and (4) failure to apply sound engineering, manufacturing, and management disciplines to designing, developing, testing, and producing support and test equipment.

Outline for Reducing Risk

- Identifying support equipment needs, as part of the supportability analysis process, is initiated as early in development as prime system concept permits.
- Test equipment performance specifications include criteria for fault detection, isolation, and false indications.
- Phased contractor support is utilized to allow for design instability.
- Test equipment performance, procedures, and software verification and validation are completed before contractor support termination.
- Upward compatibility is specified between built-in test (BIT) and intermediate, depot, and factory-levels of support equipment.
- Support and calibration requirements for test equipment are included in development and production contracts.
- Estimated costs of test program set (TPS) development are based on comparable equipment development and are funded fully.
- Support and test equipment is evaluated during formal contractor maintainability demonstrations and "in" operational tests.
- Support and test equipment design, test, production, and supportability follow the same processes outlined in this Manual for the prime equipment.

4. On some programs, training requirements are not adequately addressed, resulting in great difficulty in operating and supporting the hardware. Training programs, materials, and equipment (such as simulators) may be more complex and costly than the hardware they support. Delivering effective training materials and equipment depends on the understanding of final production design configuration, maintenance concepts, and skill levels of personnel to be trained. On many programs, training materials and equipment delivery schedules are overly ambitious. This results in poor training, inaccuracies in technical content of materials, and costly redesigning and modifying training equipment.

Outline for Reducing Risk

- Contractors are provided with clear descriptions of user personnel qualifications and current training programs of comparable systems, to be used in prime hardware and training systems design and development.
- Maintenance tasks, identified through supportability analyses, provide the data base used in comprehensive training program development systems (such as instructional systems development).
- Computer-aided techniques are used for configuration control to ensure consistency

between training materials and equipment and the systems they support.
- On-the-job training capability is incorporated in the prime equipment design as a method to reduce the need for additional training equipment.
- Complex and costly training equipment, such as simulators, is scheduled to be produced after design freeze of the prime equipment.

Training materials and equipment must match maintenance plans. Equipment built-in training features must be established early in the design phase, and the training device design must reflect stable prime equipment design.

5. Spares are a troublesome area in producing and deploying weapon systems. Spares and repair parts often do not meet the same quality and reliability levels as the prime hardware. Full spares provisioning too early in the development cycle, when there are large uncertainties in the predicted failure rates and design stability, results in procuring unneeded or unusable spares. Inadequate technical and reprocurement data frequently limits competition, acquisition flexibility, and spares manufacturing throughout the life cycle of the prime systems. Spares present a major risk of increased acquisition and support costs and reduced readiness of fielded systems.

Outline for Reducing Risk

- A spares acquisition strategy is developed early in System Development and Demonstration to identify least cost options, including combining spares procurement with production. This strategy addresses spares requirements to meet the System Development and Demonstration testing as well as the Production and Deployment phases.
- The same quality manufacturing standards and risk reduction techniques used for the prime hardware are used in the spares manufacturing and repair process.
- Transitioning from contractor to Government spares support is planned on a phased subsystem-by-subsystem basis.
- Initial spares demand factors are based on conservative engineering reliability estimates of failure rates (derived from comparability analysis) and sparing to availability analytical models. These factors are checked for reasonableness at the system or major subsystem level against laboratory and field test results and documented in the logistics management information database.
- Technical and reprocurement data are validated by analysis and, when possible, by "proof models," to ensure the quality of the spares and repair parts production process.
- Plans for developing spares procurement and manufacturing options to sustain the system until phaseout are considered in the production decision. These plans include responsibilities and funding for configuration management, engineering support, supplier identification, and configuration updates of factory test equipment to the current fielded configuration of the produced item.

Key factors in the risk equation are: operational utilization spares provisioning, design stability, adequacy of technical and reprocurement data, and quality of spares manufacturing and repair process.

6. Technical manuals frequently do not match the production configuration of the equipment supported. Technical manuals are often difficult to read and understand. These deficiencies cause delays in operational testing, low readiness rates, increased revisions change activity, and increased spares and data costs.

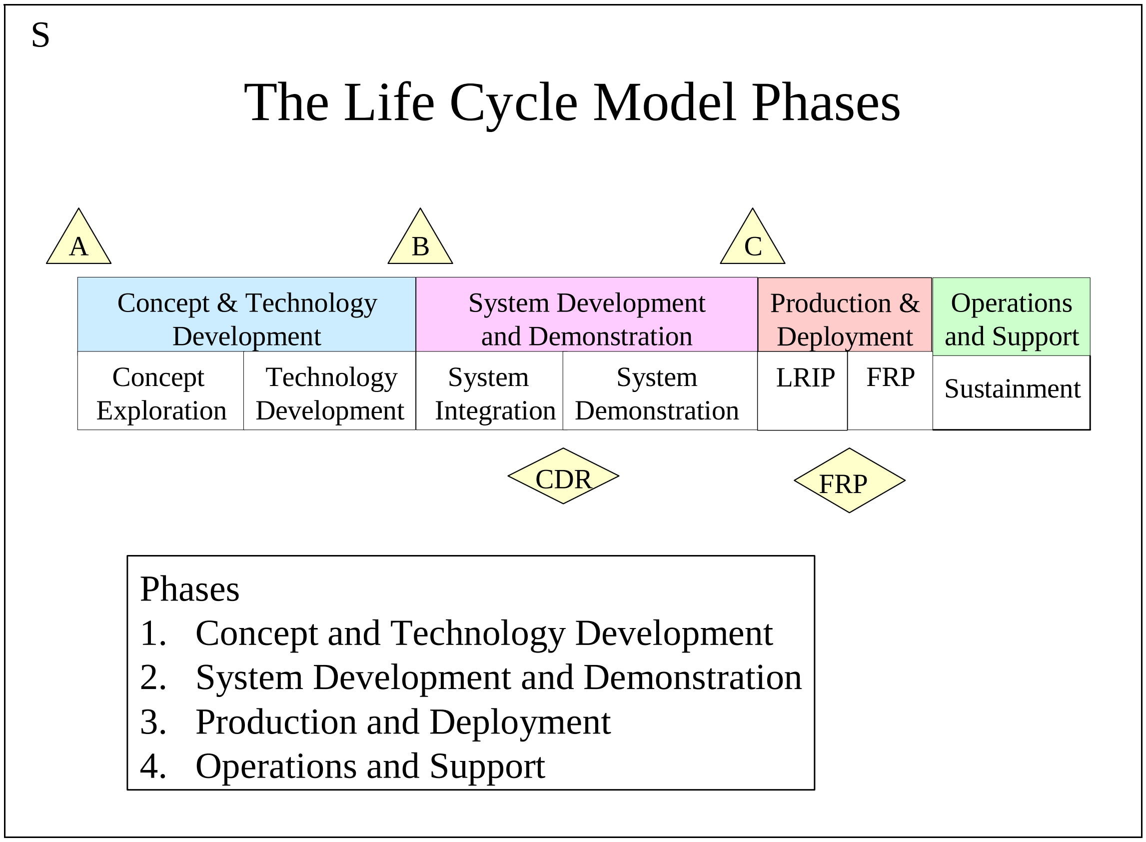
Outline for Reducing Risk

- A clear delineation of Government and contractor responsibilities in developing, verifying, validating and publishing technical manuals is outlined in the Supportability Strategy.
- Automated processes (such as the use of computer-aided engineering drawings as illustrations) are used in technical manual preparation. These processes are encouraged by request for proposal (RFP) requirements and evaluations during source selection.
- The supportability analysis process investigates technical options for portraying information including embedded and paperless delivery.
- Maintenance tasks, identified through the supportability analysis process, provide the database used in technical manual development.
- Draft manuals are validated and verified before final preparation and publication. Equipment availability to be used in verification and validation is specified in the contract.
- Automated readability analyses are used to verify that the level of the document matches the level specified.
- The milestone schedule includes interim manuals for initial training.

Developing technical manuals must be keyed to support of training requirements, engineering development models, equipment evaluation, initial production units, and update programs.

Logistics analyses are performed on design characteristics needed for operational support to the total system. These design characteristics are developed by many different disciplines pursuing a wide range of systems engineering activities. Individually they may be viewed as hardware, software, or support system design characteristics. Collectively they represent the "supportability" of a total system.

ILS emphasis during the system's life cycle



a. Concept and Technology Development Phase is the first phase of a DoD system's life cycle. If it occurs at all, it typically consists of competitive, parallel short-term concept studies performed to investigate alternative operations and design concepts. The purpose is to identify, define, and evaluate the advantages or disadvantages, risks, costs, etc. of promising operational concepts and system design alternatives. The studies project characteristics and costs of total systems as reflected by their conceptual designs. The results are reviewed at the Milestone Decision Review B where promising candidates may be selected for System Development and Demonstration.

b. The design characteristics of the selected alternative generally provide a functional baseline of the system. This baseline defines design performance characteristics required to meet operational needs. The functional baseline serves as the basis for establishing initial design thresholds and objectives. The resulting design requirements support preparation of total system design cost estimates and schedule projections and identification of trade-off opportunities. The system objectives are also the foundation for the acquisition strategy and the test and evaluation strategy.

c. The System Development and Demonstration Phase is used to further define and refine the operational concept or concepts and those alternative design approaches determined by Milestone Decision A to be the most promising. The functional baselines are further decomposed into their lower-tiered subsystems. The performance requirements of the system are then allocated down to the lower level functions. This allocated baseline is used in the supportability analyses to project operations and sustainment requirements to be satisfied in the design of the support system. Support alternatives (contractor-supplied, organic 2-level, organic 3-level, etc.) are evaluated against the operations and sustainment requirements. Support alternatives deemed not viable (those not meeting all support requirements and constraints) are discarded. Those remaining become the basis for development of initial support plans and information products (e.g., technical publications, supply support, etc.).

d. The latter part of the System Development and Demonstration Phase is used to complete a stable design for a total system, which meets the performance requirements and is producible, supportable, and affordable. Total system capabilities are demonstrated through testing to validate design assumptions, and deployment planning is initiated. Cost drivers and life cycle cost estimates are kept current with the design to reflect a more detailed understanding of the total system design characteristics. The allocated baseline of a total system is transitioned into a full product baseline during this phase. In other words, functional or allocated designs are updated to physical or product baselines representing the actual product hardware. Support system designs are updated as well to keep current with the latest design. The updated support information provides input to tradeoff and other program decisions that may be required. The updated information is also used to update or prepare logistic data products like spares lists, training packages, and technical publications required to implement the support system design.

e. Low rate initial production (LRIP) is begun during the Production and Deployment Phase. LRIP provides the minimum quantities required to support operational testing and other design validation activities and to establish an initial production base for the total system.

f. The Production and Deployment Phase includes all design activities needed to:

(1) Correct deficiencies identified during earlier test and evaluation activities and low-rate initial production.

(2) Produce and deploy a total system.

(3) Support activities respond to changes resulting from correction of noted deficiencies and other product baseline changes made to enhance producibility or other product improvements. Additionally, they prepare for transition of the system to operations.

g. The Operations and Support Phase is used to achieve and sustain an operational capability that satisfies mission needs. The footprint, size, and weight of the system and its logistic support are major considerations for contingency planners. Deploying the total system is very important and needs to be emphasized. The lift requirements and the logistics tail must be kept to a minimum. Operational needs will change over time due to product hardware modifications and aging, the emergence of new threats, changes in the support system capabilities, the introduction of new technologies, and changing economic conditions. Plans are established to monitor the rate and consequence of change on the total system supportability."[10]

The Supportability Strategy

ILS planning is a management process. It is the most important function of the ILS manager. ILS planning includes:

a. Developing and selecting alternatives to ensure that a system is designed for supportability.

b. Ensuring that the support elements for the chosen alternative will meet a time phased schedule compatible with delivering the prime end item to the user.

ILS planning is initiated early in the acquisition process and is synchronized with the overall acquisition strategy. However, there will be continuous refinements throughout the program to adjust to funding and requirements changes, technological innovation, or other problems (unknowns). The Government's planning effort is documented in the Supportability Strategy (formerly named the ILS Plan (ILSP)). The Supportability Strategy contains the management approach to developing and fielding a supportable system. The prime contractor's planning effort parallels the Government's effort and is recorded in the Supportability Strategy.

Supportability Test and Evaluation

The materiel developer must confirm the adequacy of the proposed support concept and programmed support resources prior to acquiring the system and its associated resources. Supportability and environmental test and evaluation are integral parts of both developmental and operational testing and evaluation. Evaluating system supportability issues will be performed using data from contractor and Government testing and other sources, and comparing results of the evaluation analysis against criteria based on stated system requirements and goals. Supportability testing is conducted in the controlled conditions of developmental testing (DT) and in the representative field conditions of operational testing (OT) (See AR 73-1). Supportability testing will stress using Army personnel skills, support equipment, technical manuals, tools, and TMDE, including Test Program Sets (TPS), projected for the operational environment of the organization to which the system will be assigned, including fixed support facilities in garrison. (This includes each level of maintenance below depot.) Supportability and environmental issues and requirements will be included in the Test and Evaluation Master Plan (TEMP).

The **System Support Package** (SSP) is a composite of the support resources that will be evaluated during the logistic demonstration and tested and validated during develop-

[10] MIL-HDBK-502.

mental and user tests. (The SSP includes items such as spare and repair parts, manuals, the training package, special tools and test, measurement and diagnostic equipment (TMDE), and unique software). The SSP, which validates the support system, will be differentiated from other logistic support resources and services required for initiating the test and maintaining test continuity. The SSP is a flexible instrument, tailored to the system-peculiar requirements and related to supportability testing issues. However, once the SSP for any testing phase is developed and coordinated, it should not be compromised. The SSP Component List (SSPCL) is provided 60 days before testing begins. The SSP will be delivered to the test site not later than 30 days before testing begins.

A **Logistic Demonstration** (LD) is the nondestructive disassembly and re-assembly of a system, using its related peculiar or specific TMDE, training devices, and support equipment. The system, its peculiar tools and TMDE, selected Test Program Sets (TPS), Associated Support Items of Equipment (ASIOE) and its SSP will be evaluated as a system. The LD combines selected analysis, evaluations, demonstrations and testing tailored to each acquisition program. The materiel developer will conduct an LD on all acquisition programs. Normally an LD will be conducted prior to the production decision. However, an LD may be conducted during production and deployment for commercial NDIs or other programs where an LD has not been previously conducted unless the LD requirement is specifically waived. If exceptions are required, a request for waiver will be submitted by the materiel developer to the proper milestone decision authority with supporting rationale and an alternate plan for accomplishing the LD. The purpose of the LD is to:

- Evaluate the supportability of the materiel design.
- Evaluate the adequacy of maintenance planning for the system (such as maintenance concept, task allocation, troubleshooting procedures, etc.) and its peculiar support equipment.
- Evaluate the preliminary SSP to include interface compatibility of the TMDE and support equipment with the materiel system.
- Review the technical publications.
- Validate and update logistics management information.
- Evaluate the embedded diagnostics (BIT/BITE), TMDE, TPS, and diagnostic procedures in the TM to include detection of faults inserted in the system components.

source: http://www.logsa.army.mil/alc/127/bm1_6

Summary

An effective ILS program will ensure our materiel system is:

1. Operationally effective. The system will be available when needed because of its enhanced reliability.
2. Cost effective. A significant portion of a system's life cycle cost is attributable to operational and support (O&S) costs. Adequately funding ILS early in the system's acquisition process will minimize O&S costs throughout its operational life.
3. Supportable. Integrating logistics support considerations into the design process will ensure the system will be supportable when it is fielded. This means that we should have an adequate supply of parts, trained maintenance personnel, facilities, tools, and test equipment available to keep the system operational.

No single ILS formula can be applied to all materiel acquisition programs. The ILS manager is responsible for structuring and tailoring the integrated logistics support efforts to achieve program objectives. Logistics professionals must work closely with other functional disciplines to ensure their efforts support the goals of the program manager and the acquisition process.

Review Questions

1. Define acquisition logistics.
2. Describe the objectives of the integrated logistics support program.
3. Recognize the current shift in philosophy from organic to contractor support.
4. Describe the ten ILS elements.
5. Describe the Army maintenance levels.
6. Define supportability.
7. Define:
    a. System readiness objectives (SRO).
    b. Maintenance concept.
    c. Level of repair analysis (LORA).
    d. Battlefield damage assessment and repair (BDAR).
    e. Interservice maintenance.
    f. Materiel fielding.
    g. Manpower and Personnel Integration (MANPRINT).
    h. Provisioning.
    i. Human factors engineering (HFE).
    j. Logistics Management Information (LMI).
    k. Qualitative and Quantitative Personnel Requirements Information (QQPRI).